Device for determining the days when a woman is able to conceive

Description

The invention relates to a device for determining the days when a woman is able to conceive, according to the preamble of Claim 1. Such a device is known from DE-A 32 11 573. Such a device performs an advice function in such a way that a, for example red, signal lamp lights up when triggered by the rise in temperature at ovulation and thereby indicates to the wearer a readiness to conceive owing to ovulation, with the result that she can tailor her behaviour in accordance with whether pregnancy is wanted or not wanted.

However, such a device still does not take account of the fact that male sperm remains capable of impregnation in the female body for up to 40 hours. Consequently, it is in any case frequently no longer possible to prevent an unwanted pregnancy, since it can already be "too late" at the time of ovulation.

The invention therefore creates a unit which helps here. Furthermore, the invention creates a unit with the aid of which it is possible to differentiate more effectively between the temperature increase owing to ovulation and other body temperature increases. This is achieved according to the invention by the development according to the characterizing part of Claim 1.

The unit can provide a warning even before ovulation owing to the presettable time reference value - which because of the maximum 40-hour viability of the sperm is expediently selected to be two days shorter than the interval of 1st bleeding/ovulation, the date of the ovulation usually occurring, in turn, in half of the menstruation period - in conjunction with the

(first) resettable time of day measuring instrument, which is reset at the start of the period, that is to say on the first day of the menstruation. This warning is expressed in the form of a (preferably optical) display, for example by a yellow light-emitting diode. It is also particularly advantageous in this case that a time of day measuring instrument - which can be mechanical or electronic - which therefore measures the time in 24 hour units, is sufficient. The fact that the reference value can be preset means that an adaptation to the individual length of period can be achieved. Given a satisfactorily constant period, or the acceptance of a larger safety zone, it is then possible to leave the value once preset.

Furthermore, upon the occurrence of the temperature signal without the signal from the second comparator, it can be inferred with a high probability that the temperature signal has other causes than ovulation.

A concrete embodiment of the idea of the invention can also be achieved by arranging that the first time of day measuring instrument is a down counter, and that the presetting then consists in fixing the counter reading of (for example 13) from which counting downwards is to start. The signal is then triggered at the counter reading 0.

In the case, for example of temperature measurement, a "comparator" can also be a bimetallic switch, because the latter also indicates whether a value is reached or not, and therefore does not necessarily have to be a comparator in the electronic sense. In some circumstances, the presetting is them already fixed by the design.

Particularly preferred is a second resettable time of day measuring instrument which is reset with the resetting of the first resettable time measuring instrument, and the presettable reference value can be set as a function of the measured value of said instrument, for example via a computing circuit.

If the first time measuring instrument is an up counter, the second resettable time measuring instrument can correspond with this first time measuring instrument.

The particular advantage of this design resides in that at least the presetting for the second period for which the device according to the invention is used is performed automatically. Since resetting is to be performed in each case on the day of the first menstruation, there is a full period between two such resettings. This is detected by the second time measuring instrument and then used to predict the likely date of ovulation in the next subsequent period, for example in that a computing circuit uses the final value of the second time measuring instrument to determine the day of likely ovulation (starting from resetting) and, proceeding therefrom, in turn determines the duration of the display-free time, and thus the beginning of the safety term during which the signal is to light up.

It is preferred for t_o to be determined as $t_o = \frac{t'n, \max - 1}{2} - 2$, preferably with rounding off. This takes account of the fact that the ovulation is in the middle of the period and the safety term begins expediently 48 hours, that is to say two days previously, it still being taken into account that the time of day counter already progresses in each case at the start of the next 24 hour period, for which reason $t'_{n,\ max}$, the counting of the 2nd time measuring instrument in the case of resetting, is reduced by 1.

It is preferred for a preferably optical function display to be provided. In order to raise the confidence of the user in the unit, she must be in a position to recheck its functioning. Only then can she rely on a nonappearance of the first and/or of the second, inventive signal signifying a time period free from conception.

Such a function display can preferably consist in the lighting up - continuously, or only given the absence of the first or second signal - of a preferably green signal, or, as an alternative preference, in the visibility of the preset value (for example the numeral 13). In the first case, there is an analogy to traffic light switching which is an aid to memory, green signifying the time free from conception, yellow the "safety zone" and red the time of readiness to conceive.

The measured value of the first resettable time of day measuring instrument is preferably visible on a display device, or can be called up by key actuation, and a disturbance prevents the display of the measured value. This renders it possible for the user also to find out actively how many days have passed since the beginning of the period. Because a disturbance prevents the display of the measured value, malfunctioning of the unit is made plain, as already outlined above.

It is particularly preferred to provide a third comparator for comparing the reading of the first resettable time measuring instrument with a second presettable reference value t_o' which, for $t_n \geq t_o'$ renders the signal from the second comparator and, optionally, the signal from the first comparator ineffective. The second presettable reference value is in this case, for example, expediently selected to be equal from the very start to the first presettable reference value plus 4 and thereby ensures the display device is extinguished for the second signal four days after its first occurrence. As a rule, it is also possible in this case for the display of the first signal to be switched off, since after ovulation the impregnatability is maintained only one day. However, a separate key can be used in a particularly preferred fashion to prevent the display of the first signal from being switched off, in order to be able to fix the actual onset of a pregnancy, possibly with the aid of a temperature at a continued high level. t_o' can also be

selected as a function of the occurrence of the temperature signal, for example at an interval of 2 days. It is particularly preferred to provide a memory with a display device for the value of the first resettable time measuring instrument at the time of the first occurrence of the first (temperature) signal. This memory fixes the day of ovulation, and the day of impregnation can thereby fixed precisely in the case of a pregnancy, and this in turn increases the accuracy of the calculation of the date of childbirth.

The invention is explained in still further detail below with the aid of a preferred exemplary embodiment with particular reference to the attached drawings because of their great clarity and perspicuity as regards the disclosure.

In the drawings:

Figure 1 shows a circuit diagram for illustrating the functioning according to the invention;

Figure 2 shows a top view of a device according to the invention; and

Figure 3 shows a timing diagram.

The unit provided with a battery power supply (not shown) is reset the day of the first menstruation by means of a resetting key (8). The resetting pulse passes to the first time measuring instrument 10, which is thereby set to zero and, via a connection (not shown), to a first memory 46 with the display 48 for the value of the first time measuring instrument, and via a time-delay circuit 50, whose significance is still to be explained, to a second memory S2 for the value of the first time measuring instrument 10, as well as directly to an AND gate 18, as an enabling pulse for the value of the memory S2 present at its (18) other input. The value of a memory 22 can be set with the aid of an incrementing key or keyboard 14. This value is input into the memory 22 and, preferably, also displayed (see Figure 2). An adding circuit 38 is used to add a fixed numerical value to the value

selected with the aid of the keyboard 14, and said numerical value is stored in a further memory 40.

The value of the first memory is determined such that it offers an adequate safeguard before ovulation. If, for example, the ovulation is expected on day 15 of the period starting with day 1 of the first menstruation, Z_0 is set to 13. The fixed numerical time value from 22 is present as a signal (digital or analog) t_0 at one input of a second comparator 12, at the other input of which counting of the days expired since then, t_n, starts with the day of the first menstruation as day 1.

In a corresponding way, the setting Z_0' of the memory 40 is present at the inputs of a third comparator as a signal t'_0 or the time signal from the first time measuring instrument 10. The comparators 12 and 36, output a positive signal as soon as t_n is equal to or greater than t_0 or t'_0, respectively. The signal from the second comparator 12 is present at an input of an AND gate 52 which, in the case of the presence of two positive signals, shows at its output a positive signal which signal is made visible by a display device, in the exemplary embodiment a yellow light-emitting diode, 24. As long as the third comparator 36 does not output a signal (in the present case, up to the start of the fourth day after the appearance of the signal "ge"), the AND gate 52 is held open at a high level by an output from the inverting element 54, and the signal ge can thus act for four days. With the occurrence of a positive signal at the output of the third comparator 36, the signal at the output of the inverting element 54 vanishes, and thus blocks the AND gate 52, as a result of which the signal ge can no longer advance to the display device 24.

The measured value of the time measuring instrument 10 is recorded in two memories 46 (S_1) and 16 (S_2) and displayed in display devices 48 (S_1') and 28 (S_2'), respectively (compare also Figure 2).

However, the memory S_1, 46, is set up such that after the occurrence of a signal r at the output of a first comparator 2 it holds the value then present. Since the occurrence of the signal r indicates the temperature jump at ovulation, the latter is thus stored by date (here, as a function of the start of the period). The memory S_1 can, however, also be connected to a date clock.

The signal from the memory 16 is passed by an AND gate 34, which functions like the AND gate 52, only if an enabling signal from an AND gate 32 is present at the other input of the AND gate 34. This enabling signal gr occurs only if there are present at all the inputs of the AND gate 32 enabling signals from devices which are respectively to be monitored (and which are not set forth here in detail). Thus, the appearance of the display in the display device 28 is a signal for the proper functioning of the unit. Alternatively, or in addition, the enabling signal gr can also be present at a further display device 26, a green light-emitting diode in this case.

The value in the memory 16 (S_2) which corresponds to the measurement of the time measuring instrument 10 is present at the other input of the AND gate 18, which blocks when there is no signal present at its other input. (The AND gate 18 is only a symbolic representation here, since not only a pulse, but the concrete value in S_2 must be passed). If, upon the renewed occurrence of menstruation, that is to say upon the end of the first and the start of the second period, the resetting switch 8 is now pressed, in turn, the value is passed from 16 via 18 into a computing circuit 20, which determines therefrom a value which is input into the memory 22. The value in the memory 16 naturally indicates the duration of the preceding period in full days plus 1. This arrangement is particularly expedient, since the likely day of the ovulation, which must, in turn serve to determine the starting point of the safety term, is best determined

from the duration of the preceding period. In this case, the computing circuit 20 firstly subtracts one from the value from 16, in order to obtain the duration of the period in full days, and then the middle of the period is obtained by dividing this number so obtained by two (and, if appropriate, rounding off to a whole number) and then subtracting a safety term of two days. This value is then likewise passed to the adding circuit 38 and displayed if appropriate (see Figure 2). However, the possibility of setting by using the keyboard 14 is retained. Subsequently, the memory 16 is also reset by the resetting signal from 8, an adequate time interval being achieved by a time delay circuit 50.

For the present application, the temperature sensor 1 must react to tenths of a degree. It can be a thermocouple or a resistance thermometer. It can be worn on a wrist strap like a watch, and is then expediently integrated in the display unit shown in Figure 2. However, it can also be worn on any other suitable spot on the body. The temperature measured by the temperature sensor 1 is compared with a fixed value (for example 36.9°C) which can be set at an incrementing key or keypad 4. Upon overshooting of this fixed value T_0, which is fixed by a first comparator 2, a signal r is provided at the output of the comparator. This signal is present at an input of an AND gate 56, at whose other input the signal of the inverting element 54 is present. The signal from the output of the inverting element 54 is, however, led via an OR gate 58, at whose other input there is present a signal element 42 which can be reset by a key 44 and whose positive output signal ensures that the signal r can pass the AND gate 56 irrespective of the state of the comparator V_3.

Alternatively, it is preferred (but not shown here) that the signal r can also switch off the second signal (for example via an inverting element whose output is applied to the third input of an AND gate

52', which takes the place of the AND gate 52), so that the safety term appears unambiguously as terminated. In a similar way, it is also possible, for example, for the display 26 to be switched off by the occurrence of the signal from the comparator 1 and/or the comparator 2.

Figure 2 shows a diagram of a watch-like housing on whose underside the temperature sensor is fitted, and which has the display devices 6, 24 and 26 as, respectively, red and yellow and green light-emitting diodes and the memory displays 48 and 28 as well as 5' and 22' of the memories 5 and 22 in Figure 1 (not shown in Figure 1). Also indicated symbolically are keys which serve to set the various settable values such as outlined above.

Figure 3 shows in a timing diagram the possible sequence of a period and the displays thereby occurring on the unit.

The first day, which need not coincide with the calendar day, that is to say is merely a period of 24 hours, starts with the resetting of the unit by pressing the key 8, which should, in turn, coincide with the first menstruation marked by a cross. If the monthly cycle of the wearer is, for example, 30 days, the ovulation is to be expected on the 15^{th} day (indicated in Figure 3, C by likely ovulation E_V). Depending on the safety requirement, T_0 is fixed three or two days earlier, that is to say at 12 or 13, in the present example at 12. At the start of the 12^{th} 24 hour cycle, the green display goes out (line Gr) and the yellow display begins to shine. If the ovulation now occurs in the course of the 14^{th} day (= 24-hour period), then, given appropriate circuitry, the yellow lamp is extinguished and the red lamp starts to shine. However, as indicated by dashes, the yellow lamp can also continue to shine, in order to indicate that the shining of the red lamp is not to be ascribed to some other cause but, with a high degree of likelihood, to the ovulation. Depending on whether the signal from the

third comparator is active or has been rendered inactive, the red lamp goes out at the start of the 16th day (when the adding element has added the value 4) or, as indicated by dashes, continues to shine until the temperature drops. In any case, the yellow lamp goes out at the end of the 4th 24-hour period if, as represented by dashes, it does not go out when the red one lights up. If, as indicated in row B, renewed menstruation occurs on the 29th "day" with resetting, in the present exemplary embodiment, the 14'th day (the 14th day of the new period, see line D) is then fixed as the new day of the expected ovulation $E_{v'}$, and the eleventh day is thereby fixed as the new start of the lighting up of the yellow lamp.

The unit according to Figure 2 can be made to resemble a normal watch as much as possible - and far more than illustrated - in order not to be mistaken precisely for a sensor, and it can, in particular, be provided with a cover. However, it can also be designed as a medallion and be worn at a different spot on the body, for example the armpit, or on a shoulder strap. It can also be provided with suction devices. Since the first time measuring instrument operates independently (for example also mechanically) of whether the unit is worn on the body, as the case may be, the temperature measuring unit need not be applied until the signal from the second comparator is present, or in any case need be applied in shorter intervals.

The creation of a time of day measuring instrument for use in fixing the safety term is thus also of independent, inventive significance.

Patent Claims

1. Device for determining the days when a woman is able to conceive, having a temperature sensor (1) for determining the body temperature (T), a first comparator (2) for comparing the body temperature (T) to a presettable (4) temperature reference value (T_0), which (2) outputs a first, preferably optical, (temperature) signal (r) when $T \geq T_0$, and a display device (6) for the signal (r) from the first comparator (2), characterized by a first resettable (8) time of day measuring instrument (10), a second comparator (12) for comparing the reading (t_n) of the time of day measuring instrument (10) with a presettable (14; 16, 18, 20/22) time reference value (t_0) which (12) outputs a, preferably optical, signal (ge) when $t_n \geq t_0$, and a display device (24) for the signal (ge) from the second comparator (12).

2. Device according to Claim 1, characterized by a second resettable time of day measuring instrument (10) which is reset with the resetting (8) of the first resettable time measuring instrument (10) and the presettable time reference value (t_o) can be set (20) as a function of the measured value of said instrument when resetting (16; $t'_{n,max}$).

3. Device according to Claim 2, characterized in that the presettable time reference value (t_o) is determined as $t_o = \frac{t'n, \max - 1}{2} - 2$.

4. Device according to one of Claims 1-3, characterized in that a preferably optical function display (16, 28; 26) is provided.

5. Device according to one of Claims 1-4, characterized in that the measured value (t_n) of the first resettable time of day measuring instrument (10) is visible on a display device (28) or can be called by key actuation (30) and a disturbance prevents (32, 34) the display of the measured value.

6. Device according to one of the preceding claims, characterized by a third comparator (36) for comparing the reading (t_n) of the first resettable time measuring instrument (10) with a further presettable (14, 38) time reference value (40, t_o) which, for $t_n \geq t_o'$ renders the signal (ge) from the second comparator (12) and, optionally, (42, 44) the signal (r) from the first comparator (2) ineffective.

7. Device according to one of the preceding claims, characterized in that it is designed to resemble a wrist watch (Figure 2).

8. Device according to one of the preceding claims, characterized by a memory (46) with display device (48) for the value of the first resettable time measuring instrument (10) at the time ($t_n = t_o$) of the first occurrence of the first (temperature) signal (r).

Abstract

In a device for determining the days when a woman is able to conceive, and in which a temperature sensor is used to determine the time of ovulation, an additional time of day measuring device (10) is provided which can be set to a safety term before the ovulation, and is capable thereby of reliably preventing impregnation.

Translator's Report/Comments

Your ref: DJB/KCE(DE3343020A1) **Your order (date):** **of** 23 February 2000

In translating the above text we have noted the following apparent errors/unclear passages which we have corrected or amended:

Page/para/line*	Comment
3/2	dadurch gekennzeichnet, daß → gekennzeichnet durch
5/21	optischen Anzeige) → optischen) Anzeige
6/19	z.B. →, z.B.
6/20	ist, vergesehen. → ist.
7/15	, die Zählung
8/26	Tempe-
10/25	"ge")
14/18	Sichterheitsbedürfnis → Sicherheitsbedürfnis
14/18	Delete "als".
15/18	Sauger - literally "teats" or "dummies" but translated in context as "suction devices".

* This identification refers to the source text. Please note that the first paragraph is taken to be, where relevant, the end portion of a paragraph starting on the preceding page. Where the paragraph is stated, the line number relates to the particular paragraph. Where no paragraph is stated, the line number refers to the page margin line number.